DAVID EVANS
AND ASSOCIATES INC.

PROJECT MEMORANDUM

DATE: December 19, 2013

FROM: Steven Harrison, PE – David Evans and Associates, Inc.

TO: South Cooper Mountain Technical Advisory Committee

CC: South Cooper Mountain Project Management Team

SUBJECT: **Water System Scenario Evaluation – Summary Findings and Planning Level Cost Estimates**

PROJECT: **South Cooper Mountain Concept and Community Plans**

City of Beaverton #2752-13B

DEA PROJECT NO: APGI0000-0002

This memo provides a summary to support the evaluation of the initial three (3) scenarios for the South Cooper Mountain Concept Plan including estimated water system demands and estimated waterline capacity and associated costs.1 This memo is related to the future water system infrastructure needs within the South Cooper Mountain planning area. Information was gathered from the City of Beaverton (City), Tualatin Valley Water District (TVWD), and the City of Hillsboro to identify their near term plans to provide adequate water system capacity to serve the planning area.

Evaluation Assumptions

The water system expansion into the South Cooper Mountain planning area will be based on the largest single point demand in the area. The largest single point water demand is fire service flow. Although providing domestic and irrigation services to the area is essential, the water system expansion will be developed to provide sufficient fire flow while maintaining a minimum water pressure. Therefore, the water system design will not vary based on the density of development. The City has indicated the design fire flow at any given point within the water system is 3,000 gallons per minute (gpm) while maintaining a minimum pressure of 20 pounds per square inch (psi).

Table 1. Water System Unit Costs

Ductile Iron Pipe Diameter (inches)	Unit Cost ($/LF)
12	239
16	267
20	374
24	460

[1] Descriptions of the scenarios are available at: http://www.beavertonoregon.gov/DocumentCenter/View/6489

Our evaluation did not include smaller diameter service lines (8-inches and smaller) to private land development projects, however, we did include the larger main lines (12-inches and larger) that are necessary to serve the larger area.

The unit cost for the water system is on a per linear foot basis and, in addition to raw pipe material, includes a 20% increase for miscellaneous items such as utility relocation, abandoning of existing facilities, etc.; 15% increase for general contractor profit and overhead; 25% increase for engineering and administration; and a 30% increase for general contingency. The City of Beaverton provided recommended unit costs as shown:

Water System Overview by Subarea

As stated in previous memorandums, there are three (3) subareas defined in this study. They are, as shown on the attached map, "North Cooper Mountain", "Urban Reserve Area", and "South Cooper Mountain Annexation Area". Existing water service and the anticipated types of improvements needed within each subarea are summarized briefly below.

North Cooper Mountain (NCM)

This area is largely developed with existing single family homes on large lots. TVWD currently provides water service through their existing network of waterlines and water storage tanks in this area. Further development and added water demand in this area can be served by expanding the water system network. To provide sufficient fire flow and pressures to this area, we anticipate a major water main extension through this area will be required. Potential connection points are shown in the attached scenario analysis maps.

Urban Reserve Area (URA)

This area includes the Cooper Mountain Nature Park and several dozen single family homes on large lots in the vicinity of SW 175th Avenue. TVWD currently provides water service to these properties through their existing network of waterlines. Future development and added water demand in this area can be served by expanding the existing water system network. We anticipate the expanded network will include water main pipes between 12- and 24-inches in diameter located within existing and future roadways. Points of connection can be made at SW Kemmer Road, SW Weir Road, SW Snowy Owl Lane, and/or from a main line extension through the South Cooper Mountain Annexation Area in SW 175th Avenue as shown in the attached scenario analysis maps.

South Cooper Mountain Annexation Area (SCMAA)

This subarea is also mostly undeveloped. The Beaverton School District has near-term plans to build a new high school in the area just north of SW Scholls Ferry Road and east of SW 175th Avenue starting as early as 2015. The City has indicated the school site can be adequately served from the 24-inch waterline soon to be under construction in SW Scholls Ferry Road. However, additional development to the north and west will require expanded network connections. Based on preliminary information from the City, the expansion will likely include water main pipes between 12- and 24-inches in diameter located within roadways and connections to the water storage facilities in the Hilltop area. Potential connections can be made at any point in SW Scholls Ferry Road, and/or from SW 175th Avenue. Potential connection points are shown in the scenario analysis maps.

The City is also planning a future five-million-gallon tank to be located near the intersection of SW 175th Avenue/SW Weir Road and has indicated that by supplementing the existing system with this new five-million-gallon storage tank, there will be adequate water storage to serve the entire planning area. The new tank is not included in the cost estimates in this memo because the cost does not vary between the given scenarios. Per the City, it is scheduled to be constructed by 2020.

Scenario Cost Comparison

The primary difference between the three (3) scenarios is due to the varied location of the major roadway alignments. Because the design is based on the need to provide sufficient fire flow to all areas of development, the density of development did not affect the water pipe sizes.

Scenario 1

Scenario 1 includes a 16-inch water line within North Cooper Mountain area. This new water line is not needed for new NCM growth because Scenario 1 does not include new development in this area. It is needed to create a water system loop that will serve Grabhorn Meadow to the south. The looped system will provide a network of waterlines that will deliver consistent flow and pressures to all points within the network.

The SCMAA will be served by the 24- and 16-inch water lines shown on the scenario analysis maps. Those lines extend from the 24-inch water line located in SW Scholls Ferry Road (soon to be under construction) and connect up to the water storage facilities located in the Hilltop area. To serve the initial phases of SCMAA (in the vicinity of 175th), a water line connection would be made from the new 24-inch water line located within 175th Avenue or SW Scholls Ferry Road.

Table 2. Scenario 1 - Water System Infrastructure Cost

North Cooper Mountain			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
16	7,972	267	$2,128,524
		Subarea Total:	**$2,128,524**
Urban Reserve Area			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
12	11,130	239	$2,660,070
16	12,561	267	$3,353,787
20	7,570	374	$2,831,180
24	7,172	460	$3,299,120
		Subarea Total:	**$12,144,157**

South Cooper Mountain Annexation Area			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
16	5,797	267	$1,547,799
24	11,419	460	$5,252,740
		Subarea Total:	**$6,800,539**
		Total:	**21,073,220**

Scenario 2

Scenario 2 includes a 16-inch water line within North Cooper Mountain area. This new water line will serve the new growth within NCM area. However, the main purpose of this water main is to create a water system loop that will serve Grabhorn Meadow to the south. The looped system will provide a network of waterlines that will deliver consistent flow and pressures to all points within the network.

The re-aligned 175th Avenue extending further west into the SCMAA area will also extend a 24-inch water line at that location. The east-west roadway extending from SW Alvord Lane will include a 16-inch water line. A new north-south roadway extending north from SW Vandermost Road will also include a 16-inch water line. Development occurring within the interior of SCMAA area will connect to one of these mainlines. To serve the initial phases of SCMAA (in the vicinity of 175th), a water line connection would be made from the new 24-inch water line located within 175th Avenue or SW Scholls Ferry Road.

Table 3. Scenario 2 - Water System Infrastructure Costs

North Cooper Mountain			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
16	7,927	267	$2,116,509
		Subarea Total:	**$2,116,509**
Urban Reserve Area			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
12	3,783	239	$904,137
16	11,541	267	$3,081,447
20	10,483	374	$3,920,642
24	4,951	460	$2,277,460
		Subarea Total:	**$10,183,686**

South Cooper Mountain Annexation Area			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
16	8,828	267	$2,357,076
24	11,864	460	$5,457,440
		Subarea Total:	**$7,814,516**
		Total:	**20,114,711**

Scenario 3

Scenario 3 includes a 16-inch water line within North Cooper Mountain area. This new water line will serve the new growth within NCM area. However, the main purpose of this water main is to create a water system loop that will serve Grabhorn Meadow to the south. The looped system will provide a network of waterlines that will deliver consistent flow and pressures to all points within the network.

175th Avenue remains in the same location to the north boundary of the SCMAA. In Scenario 3, the roadway curves to the northwest and eventually connects to SW 185th Avenue. This new alignment eliminates the existing sharp turns in 175th Avenue. A new 24-inch water line will extend along this new alignment to the future SW Weir Road intersection where the water line becomes a 20-inch line. The east-west roadway extending from the existing sharp turn in 175th Avenue will include a 16-inch water line. A new 24-inch water line will be extended west from the 175th/Scholls Ferry intersection to Tile Flat Road and will continue north along Tile Flat Road connecting up with the new 16-inch water line within the new east-west roadway. Development occurring within the interior of SCMAA area will connect to one of these mainlines. Service to the initial phases of SCMAA (in the vicinity of 175th), a water line connection would be made from the new 24-inch water line located within 175th Avenue or SW Scholls Ferry Road.

Table 4. Scenario 3 - Water System Infrastructure Costs

North Cooper Mountain			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
16	7,841	267	$2,093,547
		Subarea Total:	**$2,093,547**
Urban Reserve Area			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
12	4,684	239	$1,119,476
16	13,983	267	$3,733,461
20	8,740	374	$3,268,760
24	4,654	460	$2,140,840
		Subarea Total:	**$10,262,537**

South Cooper Mountain Annexation Area			
Pipe Diameter	**Total Length (ft)**	**Unit Cost ($/LF)**	**SubTotal**
12	271	239	$64,769
16	4,715	267	$1,258,905
24	12,625	460	$5,807,500
		Subarea Total:	**$7,131,174**
		Total:	**19,487,258**

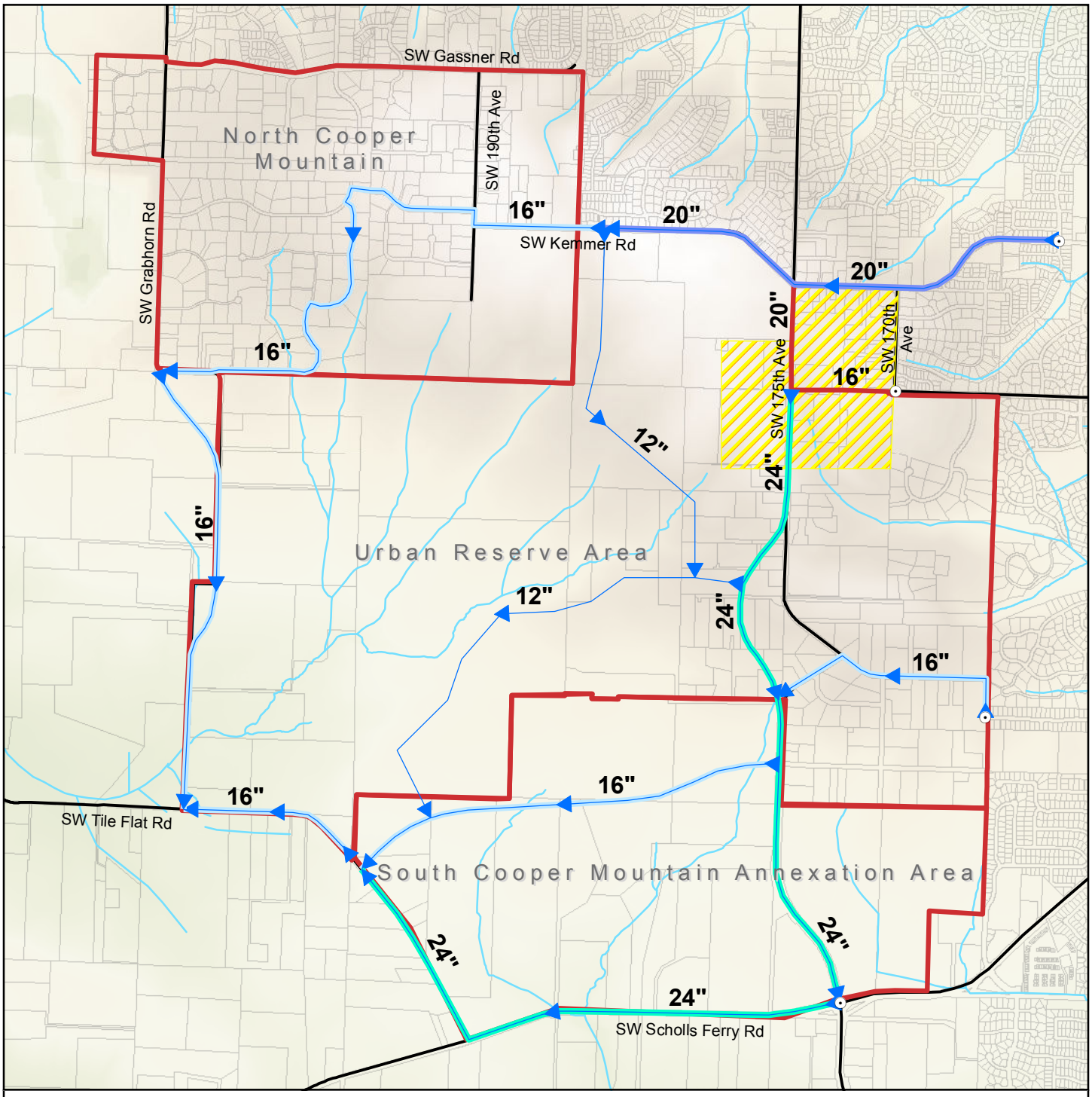
Water System Infrastructure Cost Summary

The following table summarizes the major water system infrastructure costs for the three (3) different scenarios.

Table 5. Water System Infrastructure Cost Summary

Scenario	Cost
Scenario #1 Water System Costs	$21,073,220
Scenario #2 Water System Costs	$20,114,711
Scenario #3 Water System Costs	$19,487,258

2100 SW River Parkway Portland Oregon 97201 Phone: 503.223.6663 Facsimile: 503.223.2701



South Cooper Mountain Water Lines - Scenario 1

Proposed Pipe Location, Diameter, Flow Direction

- 12"
- 16"
- 20"
- 24"

- Point of Connection
- Existing Stream
- Existing Arterial
- New Arterial
- New Collector
- Potential Reservoir Site Zone*
- South Cooper Mountain Study Area
- Washington County Taxlot

* Location of planned facility is conceptual only.

Prepared By: David Evans and Associates, Inc.

Date: 11/8/2013

Coordinate System: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl

DISCLAIMER
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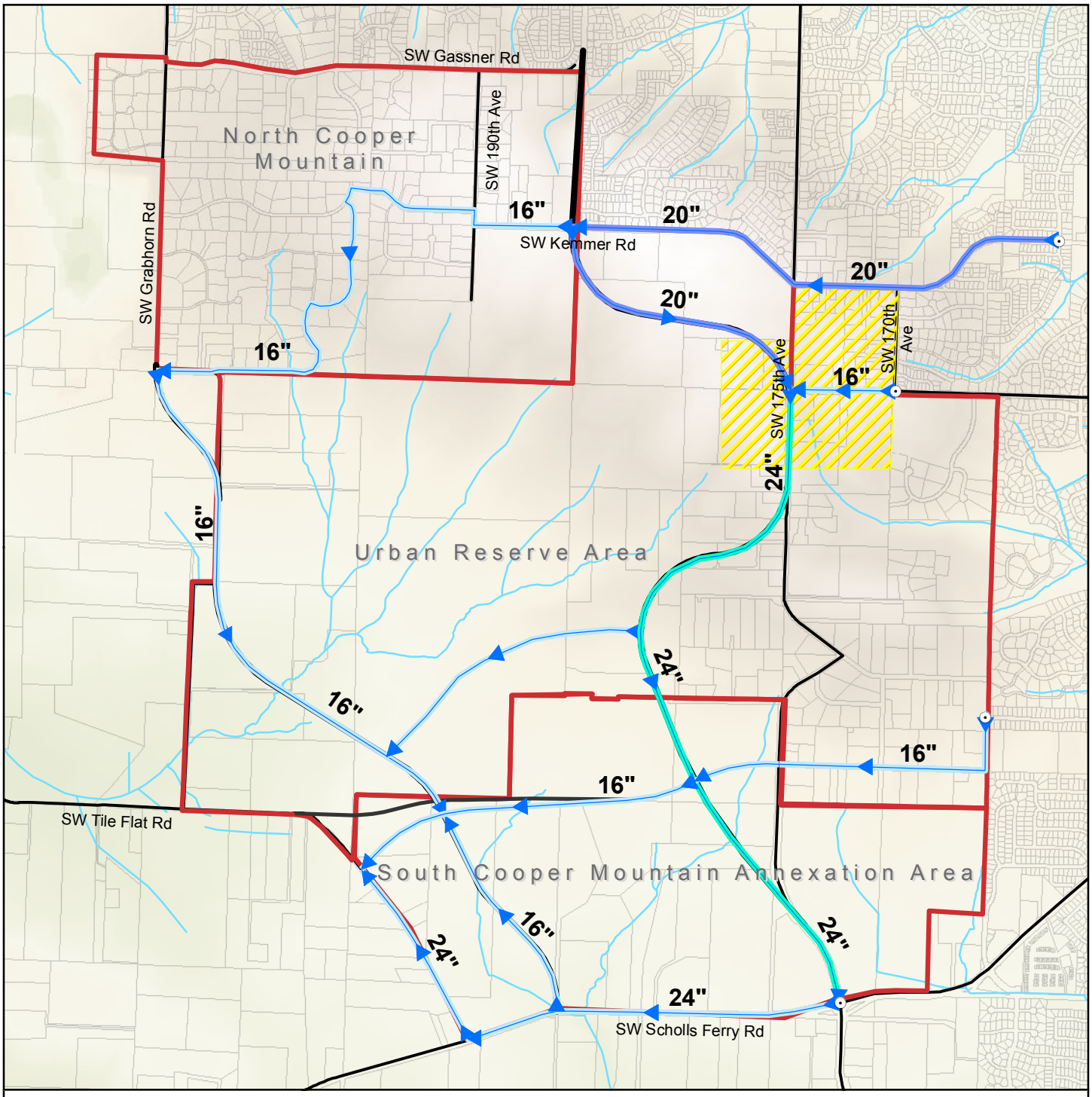

South Cooper Mountain Water Lines - Scenario 2

Proposed Pipe Location, Diameter, Flow Direction

- 12"
- 16"
- 20"
- 24"

- Point of Connection
- Existing Stream
- Existing Arterial
- New Arterial
- New Collector
- Potential Reservoir Site Zone*
- South Cooper Mountain Study Area
- Washington County Taxlot

* Location of planned facility is conceptual only.

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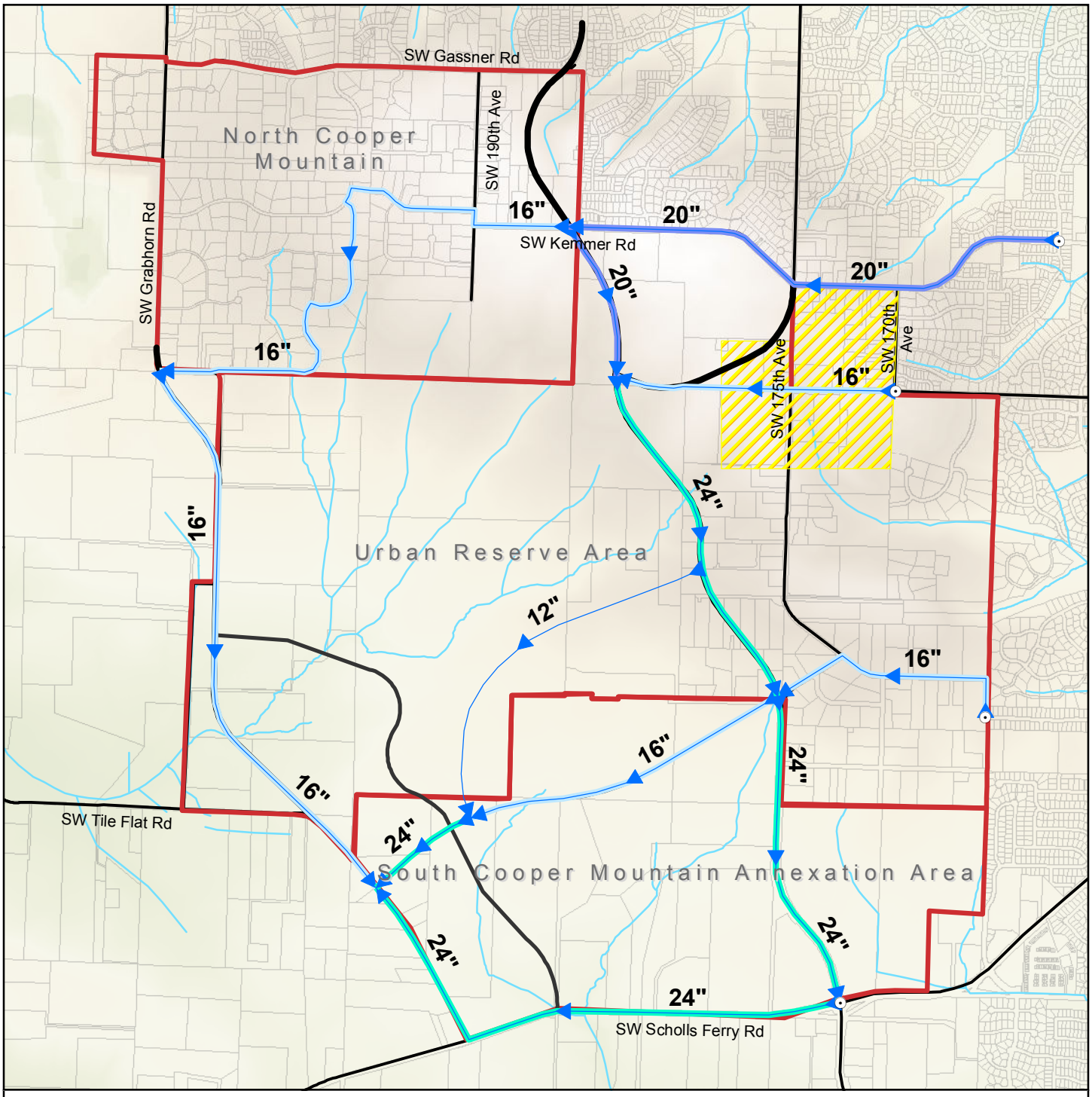

South Cooper Mountain Water Lines - Scenario 3

Proposed Pipe Location, Diameter, Flow Direction

- 12"
- 16"
- 20"
- 24"

- Point of Connection
- Existing Stream
- Existing Arterial
- New Arterial
- New Collector
- Potential Reservoir Site Zone*
- South Cooper Mountain Study Area
- Washington County Taxlot

* Location of planned facility is conceptual only.

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